

WE CLAIM:

1. An apparatus for creating an audio scene for an avatar in a virtual environment, the apparatus comprising:
  - 5 an audio processor operable to create a weighted audio stream that comprises audio from an object located in a portion of a hearing range of the avatar; and associating means operable to associate the weighted audio stream with a datum that represents a location of the portion of the hearing range in the virtual environment, wherein the weighted audio stream and the datum represent the audio scene.
- 10 2. The apparatus as claimed in Claim 1, wherein the audio processor is further operable to create the weighted audio stream such that it comprises an unweighted audio stream that comprises audio from another object located in the portion of the hearing range of the avatar.
- 15 20 3. The apparatus as claimed in Claim 1, wherein the audio processor is operable to create the weighted audio stream in accordance with a predetermined mixing operation, the predetermined mixing operation comprising identification information that identifies the object and/or the other objects, and weighting information that can be used by the audio processor to set an amplitude of the audio and unweighted audio stream in the weighted audio stream.
- 25 30 4. The apparatus as claimed in Claim 3, wherein the apparatus further comprises a communication means operable to receive the audio, the unweighted audio stream and the mixing operation via a communication network, the

communication network also being operable to send the weighted audio stream and the datum via the communication network.

5        5. An apparatus operable to create audio information for use in an audio scene for an avatar in a virtual environment, the apparatus comprising:

an audio processor operable to create an unweighted audio stream that comprises audio from an object  
10 located in a portion of a hearing range of the avatar; and associating means operable to associate the unweighted audio stream with a datum that represents an approximate location of the object in the virtual environment, wherein the unweighted audio stream and the  
15 datum represent the audio information.

6. The apparatus as claimed in Claim 5, wherein the audio processor is operable to create the unweighted audio stream in accordance with a predetermined mixing operation, the predetermined mixing operation comprising identification information that identifies the object.

7. The apparatus as claimed in Claim 6, further comprising a communication means operable to receive the audio and the predetermined mixing operation via a communication network, the communication network also being operable to send the unweighted audio stream and the datum via the communication network.

30        8. An apparatus for obtaining information that can be used to create an audio scene for an avatar in a virtual environment, the apparatus comprising:

identifying means operable to determine an

identifier of an object located in a portion of a hearing range of the avatar;

weighting means operable to determine a weighting to be applied to audio from the object; and

5 locating means operable to determine a location of the portion in the virtual environment, wherein the identifier, weighting and the location represent the information that can be used to create the audio scene.

10 9. The apparatus as claimed in Claim 8, further comprising a communication means operable to send, via a communication network, the identifier, the weighting and the location to one of a plurality of systems for processing.

15 10. The apparatus as claimed in Claim 9, wherein the communication means is further operable to create routing information for the communication network, wherein the routing information is such that it can be used by the 20 communication network to route the audio to the one of the plurality of system for processing.

11. The apparatus as claimed in Claim 8, wherein the identifying means, the weighting means and the locating 25 means are operable to respectively determine the identifier, the weighting and the location by processing a representation of the virtue environment.

12. The apparatus as claimed in Claim 8, wherein 30 the identifying means is operable to determine the portion of the hearing range by:

selecting a first of a plurality of avatars in the virtual environment;

identifying a second of the plurality of avatars that is proximate the first of the avatars;

determining whether the second of the avatars can be included in an existing cluster;

5 including the second of the avatars in the existing cluster upon determining that it can be included therein;

creating a new cluster that includes the second of the avatars upon determining that the second of the 10 avatars cannot be included in the existing cluster to thereby create a plurality of clusters;

determining an angular gap between two of the clusters;

creating a further cluster that is located in 15 the angular gap; and

including at least one of the avatars in the further cluster.

13. The apparatus as claimed in Claim 8, wherein 20 the identifying means is operable to determine the portion of the hearing range by:

selecting one of a plurality of avatars in the virtual environment;

determining a radial ray that extends from the 25 avatar to the one of the plurality of avatars;

calculating the absolute angular distance that each of the plurality of avatars is from the radial ray;

arranging the absolute angular distance of each of the avatars into an ascending ordered list;

30 calculating a differential angular separation between successive ones of the absolute angular distance in the ascending ordered list; and

selecting at least one of the differential

angular separation that has a higher value than another differential angular separation; and

5 determining another radial ray that emanates from the avatar and which bisects two of the avatars that are associated with the differential angular separation.

14. An apparatus for creating information that can be used to create an audio scene for an avatar in a virtual environment, the apparatus comprising:

10 identifying means operable to determine an identifier of an object located in a portion of a hearing range of the avatar; and

15 locating means operable to determine an approximate location of the object in the virtual environment, wherein the identifier and the approximate location represent the information that can be used to create the audio scene.

15. The apparatus as claimed in Claim 14, further comprising a communication means operable to send, via a communication network, the identifier and the location to one of a plurality of systems for processing.

16. The apparatus as claimed in Claim 15, wherein the communication means is further operable to create routing information for the communication network, wherein the routing information is such that it can be used by the communication network to route the audio to the one of the plurality of systems for processing.

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17. The apparatus as claimed in Claim 14, wherein the identifying means and the locating means are operable to respectively determine the identifier and the location

by processing a representation of the virtue environment.

18. The apparatus as claimed in Claim 14, wherein  
the identifying means is operable to determine the  
5 approximate location of the object by:

dividing the virtual environment into a  
plurality of cells; and  
determining a location in the one of the cells  
about which the object is located.

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19. An apparatus for rendering an audio scene for  
an avatar in a virtual environment, the apparatus  
comprising:

obtaining means operable to obtain a weighted  
15 audio stream that comprises audio from an object located in  
a portion of a hearing range of the avatar, and a datum  
that is associated with the weighted audio stream and which  
represents a location of the portion of the hearing range  
in the virtual environment; and

20 a spatial audio rendering engine that is  
operable to process the weighted audio stream and the datum  
in order to render the audio scene.

25 20. A method of creating an audio scene for an  
avatar in a virtual environment, the method comprising the  
steps of:

creating a weighted audio stream that comprises  
audio from an object located in a portion of a hearing  
range of the avatar; and

30 associating the weighted audio stream with a  
datum that represents a location of the portion of the  
hearing range in the virtual environment, wherein the  
weighted audio stream and the datum represent the audio

scene.

21. The method as claimed in Claim 20, wherein the  
step of creating the weighted audio stream is such that the  
5 weighted audio stream comprises an unweighted audio stream  
that comprises audio from another object located in the  
portion of the hearing range of the avatar.

22. The method as claimed in Claim 20, wherein the  
10 step of creating the weighted audio stream is carried out  
in accordance with a predetermined mixing operation, the  
predetermined mixing operation comprising identification  
information that identifies the object and/or the other  
objects, and weighting information that can be used by the  
15 audio processor to set an amplitude of the audio and  
unweighted audio stream in the weighted audio stream.

23. The method as claimed in Claim 22, further  
comprises the steps of:

20 receiving the audio, the unweighted audio  
stream and the mixing operation via a communication  
network; and

sending the weighted audio stream and the datum  
via the communication network.

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24. A method of creating audio information for use  
in an audio scene for an avatar in a virtual environment,  
the method comprising the steps of:

30 creating an unweighted audio stream that  
comprises audio from an object located in a portion of a  
hearing range of the avatar; and

associating the unweighted audio stream with a  
datum that represents an approximate location of the object

in the virtual environment, wherein the unweighted audio stream and the datum represent the audio information.

25. The method as claimed in Claim 24, wherein the  
5 step of creating the unweighted audio stream is carried out  
in accordance with a predetermined mixing operation,  
wherein the predetermined mixing operation comprising  
identification information that identifies the object.

10 26. The method as claimed in Claim 25, further  
comprising the steps of:

receiving the audio and the predetermined  
mixing operation via a communication network; and  
sending the unweighted audio stream and the  
15 datum via the communication network.

27. A method of obtaining information that can be  
used to create an audio scene for an avatar in a virtual  
environment, the method comprising the steps of:

20 determining an identifier of an object located  
in a portion of a hearing range of the avatar;

determining a weighting to be applied to audio  
from the object; and

25 determining a location of the portion in the  
virtual environment, wherein the identifier, weighting and  
the location represent the information that can be used to  
create an audio scene.

28. The method as claimed in Claim 27, further  
30 comprising the step of sending, via a communication  
network, the identifier, the weighting and the location to  
one of a plurality of systems for processing.

29. The method as claimed in Claim 28, further comprising the step of creating routing information for the communication network, wherein the routing information is such that it can be used by the communication network to 5 route the audio to the one of the plurality of system for processing.

30. The method as claimed in Claim 27, wherein the steps of determining the identifier, the weighting and the 10 location respectively comprise determining the identifier, the weighting and the location by processing a representation of the virtue environment.

31. The method as claimed in Claim 27, further 15 comprising the following steps to determine the portion of the hearing range:

selecting a first of a plurality of avatars in the virtual environment;

identifying a second of the plurality of 20 avatars that is proximate the first of the avatars;

determining whether the second of the avatars can be included in an existing cluster;

including the second of the avatars in the existing cluster upon determining that it can be included 25 therein;

creating a new cluster that includes the second of the avatars upon determining that the second of the avatars cannot be included in the existing cluster to thereby create a plurality of clusters;

30 determining an angular gap between two of the clusters;

creating a further cluster that is located in the angular gap; and

including at least one of the avatars in the further cluster.

32. The method as claimed in Claim 27, further  
5 comprising the following steps to determine the portion of  
the hearing range:

selecting one of a plurality of avatars in the virtual environment;

10 determining a radial ray that extends from the avatar to the one of the plurality of avatars;

calculating the absolute angular distance that each of the plurality of avatars is from the radial ray;

arranging the absolute distance of each of the avatars into an ascending ordered list;

15 calculating a differential angular separation between successive ones of the plurality of avatars based on the absolute angular distance;

20 selecting at least one of the differential angular separation that has a higher value than another differential angular separation; and

determining another radial ray that emanates from the avatar and which bisects two of the avatars which are associated with the differential angular separation.

25 33. A method of creating information that can be used to create an audio scene for an avatar in a virtual environment, the method comprising the steps of:

determining an identifier of an object located in a portion of a hearing range of the avatar; and

30 determining an approximate location of the object in the virtual environment, wherein the identifier and the approximate location represent the information that can be used to create the audio scene.

34. The method as claimed in Claim 33, further comprising the step of sending, via a communication network, the identifier and the location to one of a 5 plurality of systems for processing.

35. The method as claimed in Claim 34, further comprising the step of creating routing information for the communication network, wherein the routing information is 10 such that it can be used by the communication network to route the audio to the one of the plurality of systems for processing.

36. The method as claimed in Claim 33, wherein the 15 steps of determining the identifier and the approximate location respectively comprises the step of determine the identifier and the location by processing a representation of the virtue environment.

20 37. The method as claimed in Claim 33, further comprising the following steps to determine the approximate location of the object:

selecting at least once of the differential angular separation that has a higher value than another 25 differential angular separation; and

determining another radial ray that emanates from the avatar and which bisects two of the avatars that are associated with the differential angular separation.

30 38. A method of rendering an audio scene for an avatar in a virtual environment, the method comprising the steps of:

obtaining a weighted audio stream that

comprises audio from an object located in a portion of a hearing range of the avatar, and a datum that is associated with the weighted audio stream and which represents a location of the portion of the hearing range in the virtual environment; and

processing the weighted audio stream and the datum in order to render the audio scene.

39. A computer program comprising at least one instruction for causing a computing device to carry out the method defined in Claim 20.

40. A computer readable medium comprising the computer program defined in Claim 39.